# **Time Scale Effects on Accuracy of Sediment Yield Estimation**

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#### 1. Abstract

Estimation of sediment yield has always been supposed as one of the most problematic task for water specialists owing to lack of regular and persistent sediment measurement data. Because of the aforesaid issue, sediment estimation is usually made using data obtained through random sampling conducted in a particular period. In the present study, an attempt has been made to determine the range of accuracy variation in sediment estimation for a part of Haraz basin in Iran and comprises some 4023 km². The precise suspended sediment data collection in daily basis was manually made for the period of March 2004 up to March 2005 with the help of bottle samplers and using integration method. The annual sediment yield was determined on daily data basis and the sediment yield was also estimated using selection of extreme data in different combination in monthly and seasonal basis. The selected sediment data were consequently converted to annual sediment yield and ultimately compared with that obtained in daily basis. The results of the study verified a drastic variation in sediment yield estimation and then necessitate the regular and accurate measurement in data collection in the study area.

Keywords: Time Scale, Sediment Estimation, Accuracy Evaluation, Haraz River, Iran

#### 2. Introduction

Proper studying the sediment yield as one of the most important output of the watershed is a necessary prerequisite for sound watershed management and hydraulic structure design. The spatiotemporal variation of sediment yield has therefore been taken into account to consider the importance of factors affecting on sediment yield (Walling and Fang, 2003). Suspended sediment also is supposed as an indicator for the soil erosion occurred in the upland watershed (Fuller *et al.*, 2003) and can be used for watershed prioritization. Much amount of sediment load may be transported during some particular period (Ozturk and Apaydin, 2001; Sadeghi, 2004 and Parker and Trotman, 2004) which accordingly necessitate the adequate number of sampling. In the other side, the frequent sampling is very tedious and costly and thus the accuracy of irregular sampling has to be determined to evaluate the efficiency of sediment estimation which itself can project the proper manner of sediment sampling scheduling. In the present study the effect of time scale on sediment yield estimation has been considered for a medium size watershed in Iran.

#### 3. Methods

In order to achieve the study goal, a medium size watershed located in Haraz large watershed in Iran and comprises 4023 km² was selected. The Panjab study area occupies some 230km² and the outlet of the study watershed is situated on 36 05 47 N altitude and 52 16 04 E longitude. The general feature and other important specification of the study watershed have been respectively shown in Fig.1 and Table 1.

The precise suspended sediment data collection in daily basis was manually made for the period of March 2004 up to March 2005 with the help of bottle samplers and using integration method (Singh, 1992). The amount of suspended sediment was then determined using weighting method. The annual sediment yield was then calculated on daily data basis. The sediment yield was also estimated using selection of extreme data in monthly and seasonal basis. The selected sediment data were consequently converted to annual specific sediment yield and ultimately compared with that obtained in daily basis applying estimation error and bias criteria(Das, 2000).

## 4. Results

The daily sediment was calculated using analyzing daily collected suspended sediment samples and with respect to mean daily discharge. The daily values then summed up and the annual suspended sediment yield was found to be equal to 594.95 t.Km<sup>-2</sup>.y<sup>-1</sup>. The annual sediment yield was also determined using applying the minimum and the maximum values reported during each month and consequently each season and then converted into annual sediment yield. The results of the analyses have been demonstrated in Table 2.

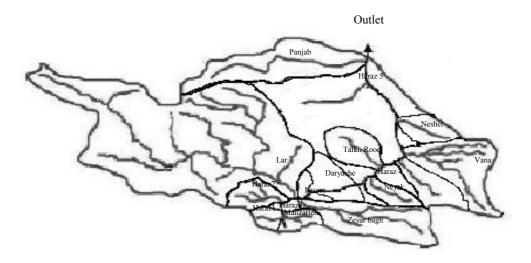


Figure 1 General feature of Panjab study watershed in Haraz basin, Iran

Table 1 Some important characteristics of Panjab study watershed

Area (Km²)	Perimeter (Km)	Slope (%)	Drainage Density (Km/km²)	Min. Elevation (m)	Max. Elevation (m)	Mean Elevation (m)	Waterway Length (m)	Waterway Slope (%)	Mean Monthly Discharge (m³/s)
253.0	73.1	45.0	1.63	867.0	4250.0	2558.5	30000	10.0	1.2

It is clearly seen from the results that the amount of predicted sediments based on minimum and maximum values reported during each study month or season cause serious under and over estimation which certainly lead to mismanagement of watershed. It is also understood from the results that the amount of annual sediment yield has been predicted at the tune of some 14 and 3000 t.Km<sup>-2</sup>.y<sup>-1</sup> which is very different with that i.e. 594.95 t.Km<sup>-2</sup>.y<sup>-1</sup> obtained through daily data analysis. It verifies an underestimation and overestimation in sediment prediction at the rate of almost 42 and 5 times less and more, respectively. While it ranges from some 1 to 1700 t.Km<sup>-2</sup>.y<sup>-1</sup>in case of applying the minimum and maximum values obtained through analysis of seasonal data i.e. almost 600 and 3 time less and more. It could also expect different values in the error and deviation in case of seasonal data analysis but it has not been ascertained owing to the lack of sampling data during some months. The results of the present research simply justify the necessity of more accurate and regular sediment sampling and measurement. More lengthy data collection and in other study watersheds is ultimately suggested to achieve a more reliable and consistent conclusion.

Table 2 Annual sediment yield based on daily, monthly, seasonal, Min. and Max. bases (t.Km<sup>-2</sup>.y) and corresponding errors (%)

corresponding errors (70)												
Month	Sediment	Min.	Error	Max.	Error	Season	Min.	Error	Max.	Error		
March	64984.20	1700.68	97.38	336454.00	-417.75		273.18	99.92	336454.0	-607.22		
April	32115.80	273.18	99.15	171843.00	-435.07	Spring						
May	42622.80	1357.19	96.82	153568.00	-260.30							
June	8897.54	0.00	100.00	87360.20	-881.85							
July	-	-	-	-	-	Summer	0.00	100.0	87360.20	-1853.34		
August	47.17	37.81	19.83	58.92	-24.92							
September	-	-	-	-	-							
October	305.76	0.00	100.00	1374.95	-349.68	Fall	0.00	100.0	1374.95	-349.68		
November	-	-	-	-	-							
December	7.51	0.00	100.00	27.55	-266.84							
January	551.15	57.30	89.60	1362.13	-147.14	Winter	0.00	100.0	5937.24	-1050.23		
February	989.89	105.77	89.31	5937.24	-499.79							
Annual Sediment	594.95	13.96		2995.99			1.08		1704.06			
Error	0.00	97.65		-403.57			99.82		-186.42			

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